Remarks

This response is being submitted within one month after the shortened statutory period set for responding to the office action that was mailed on February 20, 2003. Therefore, a petition and fee for an extension of time is enclosed with this response.

Hereinafter, the claims that are pending prior to the entry of the amendments in this response are called "currently pending claims".

Please amend currently pending claims 1, 2, 4, 5, 8 and 9. Please add new claim 15. Upon amendment the above-identified US patent application will have four independent claims (currently pending claims 1, 10 and 14 and new claim 15) and 15 total claims (currently pending claims 3, 6, 7, 10-14, amended claims 1, 2, 4, 5, 8 and 9 and new claim 15. Applicants paid for up to three independent claims and twenty total claims. Therefore fee for one independent excess claim is enclosed with this response.

1. Objections

1. Specification

Applicants submit a new abstract of the disclosure as filed on a separate page as required by 37 CFR 1.72(b).

Please correct page 8 of the specification as required in paragraph 2 on page 2 of the office action according to the attached amended page 8.

2. Claims

Please amend claims 2, 4, 5, 8 and 9 as required in paragraph 3 on page 2 of the office action according to the attached claims.

The above mentioned amendments to the specification and claims should meet the Examiner's objections on page 2 of the office action.

2. Claim rejection under 35 USC § 102

The Examiner rejects under 35 USC § 102(b) in the office action:
a) Claims 1 and 4 as being anticipated by Wang'890, in paragraph 2 of page 2,
b) Claim 1 as being anticipated by Mellors'059 in paragraph 3 of page 2,
c) Claims 1, 2, 4, 5 and 14 as being anticipated by Sheargold'679 in paragraph 4 of page 2,
d) Claims 1, 2, 4 and 5 as being anticipated by JP 11343120 in paragraph 2 of page 3.
The Examiner rejects under 35 USC § 102(e):
e) Claims 1, 2, 4, 5, 10 and 14 as being anticipated by Manev'699 in paragraph 3 on page 3.

The independent claims 1, 10, 14 and new claim 15 have the following claims limitations:
- a method for preparing a manganese compound for preparing a lithium manganese complex oxide, comprising the steps of:
- simultaneously applying a mechanical force and a heat energy to a manganese compound
- to remove defects present in particles of said manganese compound, and
- to control the aggregation of micro particles and the shape of the aggregated particles.
Applicants respectfully traverse the Examiner's assertion and submit the following summary and explanation.

a) Wang'890 describes "grinding and heat-treating EMD deposit".
b) Mellors'059 describes "intimately contacting manganous salt with permanganate by grinding, rolling, blending, etc. and heat treating the mixture".
c) Sheargold'679 describes "intimately mixing manganese compound and lithium compound by mixing in a rotating drum mixer, a vibratory mill, a jet mill, a ball mill, and then transferring the mixture to a calciner with rotating screw".
d) JP 11343120 describes "compression molding a manganese compound and lithium compound and then firing the mixture".
e) Manev'699 describes "grinding manganese dioxide to a predetermined particle size, and adding lithium compound to prepare lithium manganese oxide spinel".

Wang' 890 describes grinding and heat-treating EMD deposit but these processes are not conducted simultaneously. *Sheargold' 679* and JP 11343120 patents relate to heat-treating a mixture of manganese compound and lithium compound to prepare lithium manganese oxide spinel. However, the claim limitations of claims 1, 10, 14 and 15 simultaneously applies mechanical force and heat energy to a manganese compound to remove defects present in particles of said manganese compound, and to control the aggregation of micro particles and the shape of the aggregated particles.

Applicants do not understand how such mechanical apparatus as "grinding" lead to removing "defects present in particles of said manganese compound" as claimed in the independent claims.

In conclusion, the treatment of manganese compound in the according to claims 1, 10, 14 and 15 is clearly distinguished from the treatment of the mixture of lithium compound and manganese compound in the cited references, and the simultaneous applying of mechanical force and heat energy of the according to claims 1, 10, 14 and 15 differs from the grinding, etc. in the cited reference. Therefore, the cited references do not disclose the simultaneously applying of the mechanical force and heat energy to a manganese compound. Accordingly, Applicants strongly believe that independent claims 1, 10, 14 and 15 and therefore the dependent claims 2-9 and 11-13 are not anticipated by the cited references ((a) - (e)).

3. Claim rejections under 35 USC § 103

The Examiner rejects under 35 USC § 103(a) in the office action:
a) Claims 1, 2, 4, 5, 8, 9, 10 and 14 as being unpatentable over Manev'699, in paragraph 4 of page 5,
b) Claim 1, 2, 4-9 and 14 as being unpatentable over Howard'477 in view of Schulz'030 in paragraph 2 of page 6,
c) Claims 1, 2, 4, 5 and 14 as being anticipated by Sheargold'679 in paragraph 4 of page 2, Claims 1, 2, 4, 5, 8, 9 and 14 being unpatentable over Sheargold'679 in paragraph 4, of page 9,

d) Claims 1-2, 8-9 and 14 being unpatentable over Manthiram'755 in view of Schulz'030 in paragraph 3 of page 6,
e) Claims 1-5, 8-9 and 14 being unpatentable over Christian'257 in view of Schulz'030 in paragraph 2 of page 8,
f) Claims 1, 2, 4-9 and 14 being unpatentable over Sugeno'646 in view of Schulz' 030 in paragraph 5 of page 9,
g) Claims 1, 2, 4, 5, 8, 9 and 14 being unpatentable over JP 08102323 in view of Schulz' 030 in paragraph 2 of page 11,
i) Claims 1, 2, and 4-9 being unpatentable over JP 01263547 in view of Schulz' 030 in paragraph 3 of page 11,
k) Claims 1, 2 and 4-14 being unpatentable over JP 2000294239 in view of Sugeno' 646 and further in view of Schulz' 030 in paragraph 2 of page 12,

Applicants reviewed the cited references and respectfully summarize the Applicant's understanding of the teaching of the cited references as follows:

*a) Manev'*699 describes 'grinding manganese dioxide to a predetermined particle size, and then adding lithium compound to prepare lithium manganese oxide spinel'.
*b) Howard'*477 describes 'intimate mixing lithium compound and manganese compound and heating the mixture'. *Schulz' 030* describes that 'simultaneous grinding and heating of the alloy powder mixture can avoid structural defects'.
c) Sheargold' 679 describes 'intimately mixing manganese compound and lithium compound by mixing in a rotating drum mixer, a vibratory mill, a jet mill, a ball mill, and then transferring the mixture to a calciner with rotating screw'.
d) Manthiram' 755 describes 'mixing, stirring,vibrating or agitating the mixture of lithium compound and manganese compound, and then heat-treating the mixture to prepare spinel oxide'.
e) Christian' 257 describes 'mechanical activation of the mixture of lithium compound and manganese compound, and then heat treating the mixture to prepare lithium manganese oxide'.
f) Sugeno' 646 describes 'first heat-treating the mixture of lithium compound and manganese compound, and then crushing and second heat-treating the mixture'.

g) JP 080102323 describes 'mixing manganese compound and lithium compound and grinding the mixture, then heat-treating'.
i) JP 01263547 describes 'crushing and mixing lithium compound and manganese compound and then heat-treating to prepare spinel oxide'.
k) JP 200294239 describes 'grinding manganese dioxide, and mixing with lithium compound and firing the mixture to prepare spinel oxide'.

Applicants submit that the references *Howard' 477, Manthiram' 755, Christian' 257, Sheargold' 679, Sugeno' 646,* JP 080102323 and JP 01263547 teach heat-treating the mixture of manganese compound and lithium compound to prepare lithium manganese oxide spinel. However, the process of claims 1, 10, 14 and 15 simultaneously applies mechanical force and heat energy to a manganese compound to prepare manganese compound having improved shape without defects.

Difference between the treatment of a mixture of lithium compound and manganese and manganese compound according to the claims 1, 10, 14 and 15.
Applicants submit the following observations to explain the difference between the effects resulting from treating a mixture of lithium compound and manganese compound taught in the cited references *Howard' 477, Manthiram' 755, Christian' 257, Sheargold' 679, Sugeno' 646,* JP 080102323 and JP 01263547 and the mentioned references Wang'890, Mellors'059, JP 11343120 and Manev'699 and those from treating a manganese compound according to the claims 1, 10, 14 and 15.

The mixing of lithium compound and manganese compound and heat-treating in the cited references, which is a conventional method for preparing lithium manganese spinel from manganese compound and lithium compound, rapidly diffuses lithium into manganese compound to form lithium manganese spinel compound. Thus, lithium manganese spinel is formed without removing impurities existing in manganese compound, thereby forming lithium manganese spinel having a lot of defects is formed, responsible for deteriorating electrochemical properties of batteries, when used for a cathode active material of batteries.

In addition, in the cited references, shape of the manganese particle cannot be controlled hence lithium manganese spinel with an uncontrolled shape of manganese compound is obtained, because particle shape of lithium manganese spinel is determined by the shape of manganese compound.

The process according to the claims 1, 10, 14 and 15 yields manganese compound without defects and controlled the shape of the aggregatet particles, which can be used for preparing lithium manganese complex oxide having improved particle shape without internal defects.

Further, simultaneous application of heat and mechanical force cannot be applied when mixing lithium compound and manganese compound to prepare lithium manganese spinel, because centrifugal force is added to the mechanical force and two compounds may be separated when two or more kinds of compounds having large density difference are mixed. According to claim 14, the process for preparing a lithium manganese complex oxide is to prepare a manganese compound by simultaneously applying a mechanical force and a heat energy to a manganese compound and to mix it with a lithium compound.

JP 200294239 teaches grinding of manganese dioxide but it does not teach or suggest the simultaneously applying of the heat and mechanical force.

Schulz '030 relates to preparation of nanocrystalline alloy by intensive mechanical grinding of metal powder mixture. Even if *Schulz' 030* describes the simultaneous heat and mechanical treatment, such a treatment is conducted on a metal powder mixture comprising an alloy, which is clearly in a different technical field as the invention applying mechanical force and heat energy to a manganese compound according to claims 1, 10, 14 and 15. *Schulz' 030* pertains to a different field and teaches away from the other references and from the invention. Therefore, the skilled person would have no reason to combine the teaching of Schulz' 030 with other references.

Moreover, even if the teaching of *Schulz* '030 and other references were combined, the

invention according to claims 1, 10, 14 and 15 would not be obvious to the skilled person because simultaneously applying a mechanical force and a heat energy to a manganese compound is clearly distinguished from the treatment of a mixture of lithium compound and manganese compound in some of the cited references, and the "mechanical force and heat energy" of claims 1, 10, 14 and 15 "removes defects." How does the grinding, etc. mentioned in the cited references meet this limitation?

The references which teach the treatment of a mixture of lithium compound and manganese compound and Schulz' 030 teach away from each other. Accordingly, claims 1, 10, 14 and 15 are not obvious over *Manev' 699* or *Sheargold' 679*, or in combination with *Schulz' 030* and other references.

The mechanical force according to claims 1, 10, 14 and 15.

The mechanical force is aimed to control the aggregation of micro particles and the shapes of the aggregated particles. Applicants submit that specifically, applying mechanical force and heat energy to, for example, an angular shaped manganese compound as a raw material, a manganese compound having a shape without edges can be prepared. During the process particles adhere to the surface of a large particle or aggregate to form a larger particle.

The grinding process and similar processes in the cited reference is to decrease size of the particle in order to uniformly mix manganese compound with lithium compound. Therefore, the mechanical force of the claims 1, 10, 14 and 15 is clearly distinguished from the grinding in the cited references. Those references teach away.

In addition, during the process of particle shape control by mechanical force, simultaneous heat-treating is effective for removing defects existing in particles.

In conclusion, the treatment of manganese compound in the invention according to the independent claims 1, 10, 14 and 15 is not taught or suggested by any of the cited references. The cited references alone and in combination do not teach or suggest the simultaneously adding of the mechanical force and heat energy to a manganese

compound.

The simultaneous adding of the mechanical force and heat energy to a manganese compound is clearly not obvious over the cited references. The person of ordinary skill would not anticipate that manganese compound raw material with high purity and controlled shape, which can be used for preparing lithium manganese spinel having improved properties, is obtained by this simultaneous adding of the mechanical force and heat energy to manganese compound.

Prima facia case of obviousness.

The Examiner is respectfully reminded that to establish a *prima facia* case of obviousness, three criteria must be met.

- First, there must be some suggestion of motivation either in the reference itself or in the knowledge generally available to one of ordinary skill in the art to modify the reference teaching.
- Second, there must be a reasonable expectation of success.
- Finally, the prior art reference must teach or suggest all the claim limitations (MPEP 2142).

Applicant submits that the Examiner has failed to satisfy these criteria in asserting that the rejected claims are obvious in view of the above combined reference teachings.

The Examiner is further respectfully reminded that the teaching or suggestion to make the claimed combination and the reasonable expectation of success must be found in the prior art, therefore in the combined reference teachings and not the Applicant's disclosure.

The cited references do not teach or suggest all of the claim limitations as explained above.

The cited references do not contain any suggestion or motivation to the person of ordinary skill in the art to modify the prior art teaching and simultaneously apply a mechanical force and a heat energy to a manganese compound.

Where there would be a reasonable expectation of success?

The person skilled in the art would be motivated to improve the process of combined treatment of manganese and lithium as described by Howard '477, Manthrim '755, Christian '257, Sheargold '679, Sugeno '646, JP 080102323, and JP 01263547. The person skilled in the art would also be motivated to improve the process of grinding of combining of manganese and/or lithium oxide as described by Manev '699, JP 01263547 and JP 200294239.

The person skilled in the art would, however, not be motivated to modify any of the cited references to arrive at a process according to claims 1, 10, 14 and 15.

Clearly the only motivation or suggestion to modify the teaching must be based upon the Applicant's disclosure and not in the references. The Examiner has combined the references because of a hindsight view and not because independent claims 1, 10, 14 and 15 are obvious over the cited prior art. The same applies for the dependent claims 2-9 and 11-13.

It is therefore Applicant's belief that claims 1, 10, 14 and 15 are allowable over the cited references. Insofar as claims 2-9 and 11-13 depend from claims 1 and 10, it is Applicant's belief that these claims are also allowable.

The Applicant submits that at least the claim elements discussed above are not taught, described or suggested by the teaching of the cited references are therefore patentable. However, if the Examiner maintains his rejection of claims 1, 10, 14 and 15 and the dependent claims 2-9 and 11-13 on these grounds, the Applicant respectfully requests that the Examiner show where or how the cited references discloses each and every element of the rejected claims by recited element numbers or specific portions of the reference by column and line number and how each discloses each and every element of the rejected claim. Hence, the Applicant respectfully submits that all claims of the application are patentable over the cited reference in view of the above. Reconsideration and allowance of the pending claims are respectfully solicited.

This application is now in condition for allowance. An early date of allowance is respectfully requested.

The Commissioner is authorized to charge any additional fees which may be required or credit overpayment to deposit account no. 12-0415. In particular, if this response is not timely filed, then the Commissioner is authorized to treat this response as including a petition to extend the time period pursuant to 37 CFR 1.136 (a) requesting an extension of time of the number of months necessary to make this response timely filed and the petition fee due in connection therewith may be charged to deposit account no. 12-0415.

I hereby certify that this correspondence is being deposited with the United States Post Office with sufficient postage as first class mail in an envelope addressed to Commissioner for Patents
POB 1450, Alexandria, VA 22313-1450 on
June 20, 2003
(Date of Deposit)
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Enc. Abstract, page 8, request for extension of time and check
Check for excess claims